Emissions from Incineration of PFAS and PFAS-related compounds

Lee, C.W. and Gullett, B.K.
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A review of research on possible emissions from incineration of fluoropolymer materials has been conducted by Huber et al. (2009). The major focus of their work was on the potential emissions of greenhouse gases from municipal solid waste (MSW) incinerators burning fluoropolymers. These special plastics are widely used in different consumer products because of their unique properties such as food packaging, sports clothing, cable coating, etc. As such, they may end up in a MSW incinerator. The review found no emission data measured from full-scale MSW plants. Laboratory-scale experiments for studying degradation of fluoropolymers in the temperatures between 700 to 1,000 °C found small compounds such as CF_4, CHF_3, C_2F_6, tetrafluoroethene, and hexafluoropropene as the major degradation products. It is interesting to note that fluorinated dioxins and furans were found in thermal degradation experiments of PTFE at close to 800 °C (Herzke, 1998). The toxicity of these compounds has apparently not been studied; studies on brominated dioxins and furans have found toxicities similar to their chlorinated counterparts (Samara et al., 2009, 2010). The Huber review found a significant volume of scientific literature on thermal stability and decomposition products of PTFE. More complex species such as fluoroalkanes and alkenes, HF, oxidation products including epoxide, aldehydes, and acids, and fluoro-polymer particulates are the main degradation products at temperatures between 400 and 600 °C (the temperature range where PTFE and most other fluoropolymers start to degrade).

Summary
Numerous thermal thermolytic studies of fluorinated compounds have been conducted, identifying a number of fluorinated degradation products. The ability to translate these findings to the rapid heating and high temperature oxidation environment of an incinerator is extremely limited. An extensive literature search for information on incineration of fluorinated compounds, particularly since the 2009 Huber et al. review, did not turn up relevant information. The lack of information on combustion products of fluorinated compounds can be addressed by combustion studies both in the laboratory and field setting. The significant number of fluorinated compounds anticipated and the newness of this type of sampling suggesting that parallel efforts to develop sampling and analytical methods would be required.

References

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